

**UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF MASSACHUSETTS**

SINGULAR COMPUTING LLC,

Plaintiff,

v.

GOOGLE LLC,

Defendant.

Civil Action No. 1:21-cv-12110

Hon. F. Dennis Saylor IV

**GOOGLE LLC'S AMENDED ANSWER AND AFFIRMATIVE DEFENSES TO
PLAINTIFF SINGULAR COMPUTING LLC'S AMENDED COMPLAINT**

Defendant Google LLC, by and through counsel, submits its Second Amended Answer to Plaintiff Singular Computing LLC's ("Singular") Amended Complaint ("Complaint"), as follows:

THE PARTIES

1. Google is without knowledge or information sufficient to form a belief as to the truth of the allegations in this paragraph, and on that basis denies them.

2. Google admits that Google LLC is a Delaware limited liability company with a principal place of business at 1600 Amphitheatre Parkway, Mountain View, California 94043. Google admits that more than 1,500 employees work in its Cambridge, Massachusetts office and that its registered agent in Massachusetts is Corporation Service Company, 84 State Street, Boston, MA 02109. Google denies any remaining allegations of this paragraph.

JURISDICTION

3. Google admits that this action invokes the United States patent laws, and that this Court has subject matter jurisdiction over patent law claims. Google denies any remaining allegations of this paragraph.

4. Solely for the purpose of this action, Google does not contest personal jurisdiction in this District. Google specifically denies that it has committed any acts of infringement within the District of Massachusetts, or any other District. Google denies any remaining allegations of this paragraph.

5. Google admits that venue is proper in the District of Massachusetts for purposes of this particular action but not convenient or in the interests of justice under 28 U.S.C. 1404(a). Google specifically denies that it has committed any acts of infringement within the District of Massachusetts, or any other District. Google denies any remaining allegations of this paragraph.

FACTUAL BACKGROUND

6. Google is without knowledge or information sufficient to form a belief as to the truth of the factual allegations of this paragraph, and on that basis denies them.

7. Google admits that Sergey Brin is an alumnus of Johns Hopkins Center for Talented Youth (“CTY”). Google is without knowledge or information sufficient to form a belief as to the truth of the remaining allegations of this paragraph, and on that basis denies them.

8. Google is without knowledge or information sufficient to form a belief as to the truth of the factual allegations of this paragraph, and on that basis denies them. This paragraph also includes argument and conclusions to which no response is required, but to the extent a response is required, Google denies the allegations.

9. Google admits that over the last 50 years, there have been advances in semiconductor technology and, as Moore's Law projected, the number of transistors in an integrated circuit has doubled roughly every two years. Google is without knowledge or information sufficient to form a belief as to the truth of the remaining factual allegations of this paragraph, and on that basis denies them. This paragraph also includes argument and conclusions to which no response is required, but to the extent a response is required, Google denies the allegations.

10. Google is without knowledge or information sufficient to form a belief as to the truth of the factual allegations of this paragraph, and on that basis denies them. This paragraph also includes argument and conclusions to which no response is required, but to the extent a response is required, Google denies the allegations.

11. Google is without knowledge or information sufficient to form a belief as to the truth of the factual allegations of this paragraph, and on that basis denies them. This paragraph

also includes argument and conclusions to which no response is required, but to the extent a response is required, Google denies the allegations.

12. Google is without knowledge or information sufficient to form a belief as to the truth of the factual allegations of this paragraph, and on that basis denies them. This paragraph also includes argument and conclusions to which no response is required, but to the extent a response is required, Google denies the allegations.

13. Google admits that patent application No. 61/218,691, on its face, bears the title quoted in this paragraph and was filed in June 2009. Google is without knowledge or information sufficient to form a belief as to when the provisional application was made public, and on that basis denies that allegation. Google denies the remaining allegations in this paragraph.

14. Google is without knowledge or information sufficient to form a belief as to the truth of the allegations of this paragraph, and on that basis denies them.

15. Google admits that it provides services such as Translate, Photos, Search, Image Search, Assistant, and Gmail. Google denies any remaining allegations in this paragraph.

16. Google admits that it uses some TPU devices to support some Google products. Google admits that Google's parent company, Alphabet Inc., reported worldwide net income of approximately \$40 billion in 2020. This paragraph includes argument and conclusions to which no response is required, but to the extent a response is required, Google denies the allegations. Google denies any remaining allegations in this paragraph. Google specifically denies that it has committed any acts of infringement.

17. Google admits that, as of 2017, it had at least eight data centers in the United States and that some data centers did contain some TPU devices. Google denies any remaining

allegations in this paragraph. Google specifically denies that it has committed any acts of infringement.

18. Google admits that it currently operates data centers in Berkeley County, South Carolina; Council Bluffs, Iowa; The Dalles, Oregon; Douglas County, Georgia; Henderson, Nevada; Jackson County, Alabama; Lenoir, North Carolina; Loudoun County, Virginia; Mayes County, Oklahoma; Midlothian, Texas; Montgomery County, Tennessee; New Albany, Ohio; Papillon, Nebraska, and Storey County, Nevada. Google admits that some data centers do contain some TPU devices. Google denies any remaining allegations in this paragraph.

19. Google admits that Google's parent company, Alphabet Inc., reported worldwide net income of approximately \$40 billion in 2020 in Alphabet's Securities and Exchange Commission Form 10-K form signed on February 2, 2021. Google admits that Google's parent company, Alphabet Inc., reported worldwide revenue of approximately \$182.5 billion in 2020 in the same 10-K form. Google denies any remaining allegations in this paragraph.

THE PATENTS-IN-SUIT

20. Google admits that United States Patent No. 10,754,616 ("the '616 Patent"), on its face, bears the title quoted in this paragraph and an issuance date of August 25, 2020. Google denies that the '616 Patent was duly and legally issued. Google denies any remaining allegations of this paragraph.

21. Google admits that United States Patent No. 11,169,775 ("the '775 Patent"), on its face, bears the title quoted in this paragraph and an issuance date of November 9, 2021. Google denies that the '775 Patent was duly and legally issued. Google denies any remaining allegations of this paragraph.

22. Google admits that the '616 patent and the '775 patent, on their face, claim priority to application No. 61/218,691. Google admits that provisional application No. 61/218,691, on its face, was dated June 19, 2009. Google denies any remaining allegations of this paragraph.

23. Google is without knowledge or information sufficient to form a belief as to the truth of the allegations of this paragraph, and on that basis denies them.

24. Google denies the allegations of this paragraph.

25. Google admits that Claims 7, 8, and 10 of the '616 patent, on their face, contain at least some of the language quoted in this paragraph but denies that this is an accurate reproduction of claims 7, 8, and 10 of the '616 patent. Google denies any remaining allegations of this paragraph.

26. Google admits that Claim 1 of the '775 patent, on its face, contains the language quoted in this paragraph. Google denies any remaining allegations of this paragraph.

27. This paragraph sets forth argument and legal conclusions to which no response is required. To the extent this paragraph includes any allegations to which a response is required, Google denies them.

28. This paragraph sets forth argument and legal conclusions to which no response is required. To the extent this paragraph includes any allegations to which a response is required, Google denies them.

29. This paragraph sets forth argument and legal conclusions to which no response is required. To the extent this paragraph includes any allegations to which a response is required, Google denies them.

30. This paragraph sets forth argument and legal conclusions to which no response is required. To the extent this paragraph includes any allegations to which a response is required, Google denies them.

31. This paragraph sets forth argument and legal conclusions to which no response is required. To the extent this paragraph includes any allegations to which a response is required, Google denies them.

32. This paragraph sets forth argument and legal conclusions to which no response is required. To the extent this paragraph includes any allegations to which a response is required, Google denies them.

33. This paragraph sets forth argument and legal conclusions to which no response is required. To the extent this paragraph includes any allegations to which a response is required, Google denies them.

34. This paragraph sets forth argument and legal conclusions to which no response is required. To the extent this paragraph includes any allegations to which a response is required, Google denies them.

35. This paragraph sets forth argument and legal conclusions to which no response is required. To the extent this paragraph includes any allegations to which a response is required, Google denies them.

36. This paragraph sets forth argument and legal conclusions to which no response is required. To the extent this paragraph includes any allegations to which a response is required, Google denies them.

37. This paragraph sets forth argument and legal conclusions to which no response is required. To the extent this paragraph includes any allegations to which a response is required, Google denies them.

38. This paragraph sets forth argument and legal conclusions to which no response is required. To the extent this paragraph includes any allegations to which a response is required, Google denies them.

COUNT I (INFRINGEMENT OF THE '775 PATENT)

39. Google incorporates by reference its responses to the allegations of paragraphs 1 to 38 above as its response to this paragraph.

40. Google denies the allegations in this paragraph, and specifically denies that it has committed any acts of infringement.

41. Google admits that the language depicted in this paragraph as “according to Google” appears on a Google website. Google denies the remaining allegations in this paragraph.

42. Google denies the allegations in this paragraph. Google is without knowledge or information sufficient to form a belief as to the truth of the remaining allegations of this paragraph, and on that basis denies them.

43. This paragraph is vague and does not appear to set forth an allegation to which a response is required. To the extent this paragraph includes any allegations to which a response is required, Google denies them.

44. Google admits that the language and images quoted in this paragraph as what “Google describes” previously appeared on a Google website. Google denies the remaining allegations in this paragraph.

45. Google admits that some of the language quoted in this paragraph as “according to cloud.google.com” appears in part on a Google website. Google denies that the material in this paragraph from the cited medium.com website is attributable to Google. Google denies the remaining allegations in this paragraph.

46. Google admits that the image depicted in this paragraph appears on a Google website. Several of the terms in this paragraph are vague and undefined; thus, Google lacks sufficient knowledge and information to form a belief as to the truth of those allegations, and on that basis denies them. This paragraph also incorporates argument and legal conclusions regarding claim language, to which no response is required, but to the extent a response is required, Google denies the allegations. Google denies the remaining allegations in this paragraph, and specifically denies that it has committed any acts of infringement.

47. Google admits that the image depicted in this paragraph appears on a Google website. Several of the terms in this paragraph are vague and undefined; thus, Google lacks sufficient knowledge and information to form a belief as to the truth of those allegations, and on that basis denies them. This paragraph also incorporates argument and legal conclusions regarding claim language, to which no response is required, but to the extent a response is required, Google denies the allegations. Google denies the remaining allegations in this paragraph, and specifically denies that it has committed any acts of infringement.

48. Google admits that the third image included in this paragraph appears on a Google website. Several of the terms in this paragraph are vague and undefined; thus, Google lacks sufficient knowledge and information to form a belief as to the truth of those allegations, and on that basis denies them. This paragraph also incorporates argument and legal conclusions regarding claim language, to which no response is required, but to the extent a response is

required, Google denies the allegations. Google denies the remaining allegations in this paragraph, and specifically denies that it has committed any acts of infringement.

49. Singular’s allegations in this paragraph incorporate a number of “aforementioned” references, which are ambiguous in definition and scope. Thus, Google incorporates by reference its responses to the allegations in paragraphs 1 through 48. Google admits that the first image included in this paragraph appears on a Google website. Google admits that it applied for and was granted U.S. Patent No. 10,621,269. Google denies that it has represented that the ’269 patent specification is reflective of the accused TPUs’ chips. Google admits that some of the images depicted in this paragraph appear in U.S. Patent No. 10,621,269. Several of the terms in this paragraph are vague and undefined; thus, Google lacks sufficient knowledge and information to form a belief as to the truth of those allegations, and on that basis denies them. This paragraph also incorporates argument and legal conclusions regarding claim language, to which no response is required, but to the extent a response is required, Google denies the allegations. Google denies the remaining allegations in this paragraph, and specifically denies that it has committed any acts of infringement.

50. Singular’s allegations in this paragraph incorporate an “aforementioned” reference, which is ambiguous in definition and scope. Thus, Google incorporates by reference its responses to the allegations in paragraphs 1 through 49. Google admits that the images depicted in this paragraph appear in U.S. Patent No. 10,621,269. This paragraph incorporates argument and legal conclusions regarding claim language, to which no response is required. To the extent a response is required, Google denies the allegations.

51. Singular’s allegations in this paragraph incorporate an “aforementioned” reference, which is ambiguous in definition and scope. Thus, Google incorporates by reference

its responses to the allegations in paragraphs 1 through 50. Google admits that the images depicted in this paragraph appear in U.S. Patent No. 10,621,269. Several of the terms in this paragraph are vague and undefined; thus, Google lacks sufficient knowledge and information to form a belief as to the truth of those allegations, and on that basis denies them. This paragraph also incorporates argument and legal conclusions regarding claim language, to which no response is required, but to the extent a response is required, Google denies the allegations. Google denies the remaining allegations in this paragraph, and specifically denies that it has committed any acts of infringement.

52. Singular's allegations in this paragraph incorporate an "aforementioned" reference, which is ambiguous in definition and scope. Thus, Google incorporates by reference its responses to the allegations in paragraphs 1 through 51. Google admits that the images depicted in this paragraph appear in U.S. Patent No. 10,621,269. Several of the terms in this paragraph are vague and undefined; thus, Google lacks sufficient knowledge and information to form a belief as to the truth of those allegations, and on that basis denies them. This paragraph also incorporates argument and legal conclusions regarding claim language, to which no response is required, but to the extent a response is required, Google denies the allegations. Google denies the remaining allegations in this paragraph, and specifically denies that it has committed any acts of infringement.

53. Singular's allegations in this paragraph incorporate multiple "aforementioned" references, which are ambiguous in definition and scope. Thus, Google incorporates by reference its responses to the allegations in paragraphs 1 through 52. Google admits that the first image depicted in this paragraph appears on a Google website. Google admits that the second image depicted in this paragraph appears in U.S. Patent No. 10,621,269. Several of the terms in this

paragraph are vague and undefined; thus, Google lacks sufficient knowledge and information to form a belief as to the truth of those allegations, and on that basis denies them. This paragraph also incorporates argument and legal conclusions regarding claim language, to which no response is required, but to the extent a response is required, Google denies the allegations. Google denies the remaining allegations in this paragraph, and specifically denies that it has committed any acts of infringement.

54. Singular's allegations in this paragraph incorporate a number of "aforementioned" references, which are ambiguous in definition and scope. Thus, Google incorporates by reference its responses to the allegations in paragraphs 1 through 53. Google admits that the language and images depicted in the first three images in this paragraph as being "excerpted from Google's own published documentation" appear on a Google website. Google admits that the last image depicted in this paragraph appears in U.S. Patent No. 10,621,269. Several of the terms in this paragraph are vague and undefined; thus, Google lacks sufficient knowledge and information to form a belief as to the truth of those allegations, and on that basis denies them. This paragraph also incorporates argument and legal conclusions regarding claim language, to which no response is required, but to the extent a response is required, Google denies the allegations. Google denies the remaining allegations in this paragraph, and specifically denies that it has committed any acts of infringement.

55. Google admits that the image included in this paragraph as "Google's published documents" appears on a Google website. Several of the terms in this paragraph are vague and undefined; thus, Google lacks sufficient knowledge and information to form a belief as to the truth of those allegations, and on that basis denies them. This paragraph also incorporates argument and legal conclusions regarding claim language, to which no response is required, but

to the extent a response is required, Google denies the allegations. Google denies the remaining allegations in this paragraph, and specifically denies that it has committed any acts of infringement.

56. Google incorporates by reference its responses to the allegations in paragraphs 1 through 55. Several of the terms in this paragraph are vague and undefined; thus, Google lacks sufficient knowledge and information to form a belief as to the truth of those allegations, and on that basis denies them. This paragraph also incorporates argument and legal conclusions, including references to undefined claim language, to which no response is required, but to the extent a response is required, Google denies the allegations. Google denies any additional allegations of this paragraph. Google specifically denies that it has committed any acts of infringement.

57. Singular's allegations in this paragraph incorporate a number of "aforementioned" references, which are ambiguous in definition and scope. Thus, Google incorporates by reference its responses to the allegations in paragraphs 1 through 56. Google admits that the following language quoted in the paragraph appears on a Google website: "The VPU handles float32 and int32 computations." Google admits that the language depicted in the image in this paragraph appears in U.S. Patent No. 10,621,269. Several of the terms in this paragraph are vague and undefined; thus, Google lacks sufficient knowledge and information to form a belief as to the truth of those allegations, and on that basis denies them. This paragraph also incorporates argument and legal conclusions regarding claim language, to which no response is required, but to the extent a response is required, Google denies the allegations. Google denies the remaining allegations in this paragraph, and specifically denies that it has committed any acts of infringement.

58. Singular’s allegations in this paragraph incorporate multiple “aforementioned” references, which are ambiguous in definition and scope. Thus, Google incorporates by reference its responses to the allegations in paragraphs 1 through 57. Google admits that Jeffrey Dean’s article, *The Deep Learning Revolution and Its Implications for Computer Architecture and Chip Design*, contains the language quoted in this paragraph. Google admits that the article authored by Jouppi, et al., *Ten Lessons From Three Generations Shaped Google’s TPUv4i: Industrial Product*, contains the image reproduced in this paragraph without the added emphasis. Several of the terms in this paragraph are vague and undefined; thus, Google lacks sufficient knowledge and information to form a belief as to the truth of those allegations, and on that basis denies them. This paragraph also incorporates argument and legal conclusions regarding claim language, to which no response is required, but to the extent a response is required, Google denies the allegations. Google denies the remaining allegations in this paragraph, and specifically denies that it has committed any acts of infringement.

59. Google admits that the ’775 patent, on its face, contains the language depicted in the image in this paragraph. This paragraph includes argument and legal conclusions to which no response is required, but to the extent a response is required, Google denies the allegations. Google denies the remaining allegations in this paragraph, and specifically denies that it has committed any acts of infringement.

60. Google admits that its Petition for *Inter Partes* Review in IPR2021-00154 referenced application No. 16/882,694. Several of the terms in this paragraph are vague and undefined; thus, Google lacks sufficient knowledge and information to form a belief as to the truth of those allegations, and on that basis denies them. Google denies the remaining allegations in this paragraph, and specifically denies that it has committed any acts of infringement.

61. This paragraph includes argument and conclusions to which no response is required, but to the extent a response is required, Google denies the allegations. Google specifically denies that it has committed any acts of infringement.

62. Google denies the allegations of this paragraph. Google specifically denies that it has committed any acts of infringement.

COUNT II (INFRINGEMENT OF THE '616 PATENT)

63. Google incorporates by reference its responses to the allegations of paragraphs 1 to 62 above as its response to this paragraph.

64. Google denies the allegations in this paragraph, and specifically denies that it has committed any acts of infringement.

65. Google admits that the image depicted in this paragraph appears on a Google website. Several of the terms in this paragraph are vague and undefined; thus, Google lacks sufficient knowledge and information to form a belief as to the truth of those allegations, and on that basis denies them. This paragraph also incorporates argument and legal conclusions regarding claim language, to which no response is required, but to the extent a response is required, Google denies the allegations. Google denies the remaining allegations in this paragraph, and specifically denies that it has committed any acts of infringement.

66. Google admits that the third image included in this paragraph appears on a Google website. Several of the terms in this paragraph are vague and undefined; thus, Google lacks sufficient knowledge and information to form a belief as to the truth of those allegations, and on that basis denies them. This paragraph also incorporates argument and legal conclusions regarding claim language, to which no response is required, but to the extent a response is

required, Google denies the allegations. Google denies the remaining allegations in this paragraph, and specifically denies that it has committed any acts of infringement.

67. Singular’s allegations in this paragraph incorporate an “aforementioned” reference, which is ambiguous in definition and scope. Thus, Google incorporates by reference its responses to the allegations in paragraphs 1 through 66. Google admits that the first image depicted in this paragraph as “excerpts from Google’s own publications” previously appeared on a Google website. Google denies that the material in this paragraph, which appears to be from the cited medium.com website in Paragraph 45 of the Amended Complaint, is attributable to Google. Google admits that some of the images depicted in this paragraph appear in U.S. Patent No. 10,621,269. Several of the terms in this paragraph are vague and undefined; thus, Google lacks sufficient knowledge and information to form a belief as to the truth of those allegations, and on that basis denies them. This paragraph also incorporates argument and legal conclusions regarding claim language, to which no response is required, but to the extent a response is required, Google denies the allegations. Google denies the remaining allegations in this paragraph, and specifically denies that it has committed any acts of infringement.

68. Google admits that the language depicted in the image in this paragraph as “published by Google” appears on a Google website. Several of the terms in this paragraph are vague and undefined; thus, Google lacks sufficient knowledge and information to form a belief as to the truth of those allegations, and on that basis denies them. This paragraph also incorporates argument and legal conclusions regarding claim language, to which no response is required, but to the extent a response is required, Google denies the allegations. Google denies the remaining allegations in this paragraph, and specifically denies that it has committed any acts of infringement.

69. Singular’s allegations in this paragraph incorporate multiple “aforementioned” references, which are ambiguous in definition and scope. Thus, Google incorporates by reference its responses to the allegations in paragraphs 1 through 68. Google admits that the first image included in this paragraph appears on a Google website. Google admits that the remaining images depicted in this paragraph appear in U.S. Patent No. 10,621,269. Several of the terms in this paragraph are vague and undefined; thus, Google lacks sufficient knowledge and information to form a belief as to the truth of those allegations, and on that basis denies them. This paragraph also incorporates argument and legal conclusions regarding claim language, to which no response is required, but to the extent a response is required, Google denies the allegations. Google denies the remaining allegations in this paragraph, and specifically denies that it has committed any acts of infringement.

70. Singular’s allegations in this paragraph incorporate multiple “aforementioned” references, which are ambiguous in definition and scope. Thus, Google incorporates by reference its responses to the allegations in paragraphs 1 through 69. Google admits that the images depicted in this paragraph appear in U.S. Patent No. 10,621,269. Several of the terms in this paragraph are vague and undefined; thus, Google lacks sufficient knowledge and information to form a belief as to the truth of those allegations, and on that basis denies them. This paragraph also incorporates argument and legal conclusions regarding claim language, to which no response is required, but to the extent a response is required, Google denies the allegations. Google denies the remaining allegations in this paragraph, and specifically denies that it has committed any acts of infringement.

71. Singular’s allegations in this paragraph incorporate multiple “aforementioned” references, which are ambiguous in definition and scope. Thus, Google incorporates by

reference its responses to the allegations in paragraphs 1 through 70. Google admits that the first image included in this paragraph appears on a Google website. Google admits that the remaining images depicted in this paragraph appear in U.S. Patent No. 10,621,269. Several of the terms in this paragraph are vague and undefined; thus, Google lacks sufficient knowledge and information to form a belief as to the truth of those allegations, and on that basis denies them. This paragraph also incorporates argument and legal conclusions regarding claim language, to which no response is required, but to the extent a response is required, Google denies the allegations. Google denies the remaining allegations in this paragraph, and specifically denies that it has committed any acts of infringement.

72. Singular’s allegations in this paragraph incorporate multiple “aforementioned” references, which are ambiguous in definition and scope. Thus, Google incorporates by reference its responses to the allegations in paragraphs 1 through 71. Google admits that the images depicted in this paragraph appear in U.S. Patent No. 10,621,269. Google denies that “<https://cloud.google.com/tpu/docs/beginners-guide>” contains the following language quoted in this paragraph: “the TPU loads the parameters from memory into the matrix of multipliers and adders.” Several of the terms in this paragraph are vague and undefined; thus, Google lacks sufficient knowledge and information to form a belief as to the truth of those allegations, and on that basis denies them. This paragraph also incorporates argument and legal conclusions regarding claim language, to which no response is required, but to the extent a response is required, Google denies the allegations. Google denies the remaining allegations in this paragraph, and specifically denies that it has committed any acts of infringement.

73. Singular’s allegations in this paragraph incorporate multiple “aforementioned” references, which are ambiguous in definition and scope. Thus, Google incorporates by

reference its responses to the allegations in paragraphs 1 through 72. Google admits that the images depicted in this paragraph appear in U.S. Patent No. 10,621,269. Several of the terms in this paragraph are vague and undefined; thus, Google lacks sufficient knowledge and information to form a belief as to the truth of those allegations, and on that basis denies them. This paragraph also incorporates argument and legal conclusions regarding claim language, to which no response is required, but to the extent a response is required, Google denies the allegations. Google denies the remaining allegations in this paragraph, and specifically denies that it has committed any acts of infringement.

74. Singular's allegations in this paragraph incorporate multiple "aforementioned" references, which are ambiguous in definition and scope. Thus, Google incorporates by reference its responses to the allegations in paragraphs 1 through 73. Google admits that the first image depicted in this paragraph appears on a Google website. Google admits that the remaining images depicted in this paragraph appear in U.S. Patent No. 10,621,269. Several of the terms in this paragraph are vague and undefined; thus, Google lacks sufficient knowledge and information to form a belief as to the truth of those allegations, and on that basis denies them. This paragraph also incorporates argument and legal conclusions regarding claim language, to which no response is required, but to the extent a response is required, Google denies the allegations. Google denies the remaining allegations in this paragraph, and specifically denies that it has committed any acts of infringement.

75. Singular's allegations in this paragraph incorporate an "aforementioned" reference, which is ambiguous in definition and scope. Thus, Google incorporates by reference its responses to the allegations in paragraphs 1 through 74. Google admits that the language and images depicted in the first three images in this paragraph as being "excerpted from Google's

own published documentation” appear on a Google website. Google admits that the last image depicted in this paragraph appears in U.S. Patent No. 10,621,269. Several of the terms in this paragraph are vague and undefined; thus, Google lacks sufficient knowledge and information to form a belief as to the truth of those allegations, and on that basis denies them. This paragraph also incorporates argument and legal conclusions regarding claim language, to which no response is required, but to the extent a response is required, Google denies the allegations. Google denies the remaining allegations in this paragraph, and specifically denies that it has committed any acts of infringement.

76. Google admits that the image included in this paragraph as “Google’s own publications” appears on a Google website. Several of the terms in this paragraph are vague and undefined; thus, Google lacks sufficient knowledge and information to form a belief as to the truth of those allegations, and on that basis denies them. This paragraph also incorporates argument and legal conclusions regarding claim language, to which no response is required, but to the extent a response is required, Google denies the allegations. Google denies the remaining allegations in this paragraph, and specifically denies that it has committed any acts of infringement.

77. Singular’s allegations in this paragraph incorporate a reference to unspecified descriptions “above” attributed to Google, an allegation which is ambiguous and unclear in definition and scope. Thus, Google incorporates by reference its responses to the allegations in paragraphs 1 through 76. Several of the terms in this paragraph are vague and undefined; thus, Google lacks sufficient knowledge and information to form a belief as to the truth of those allegations, and on that basis denies them. This paragraph also incorporates argument and legal conclusions, including references to undefined claim language, to which no response is required,

but to the extent a response is required, Google denies the allegations. Google denies any additional allegations of this paragraph. Google specifically denies that it has committed any acts of infringement.

78. Singular’s allegations in this paragraph incorporate multiple “aforementioned” references, which are ambiguous in definition and scope. Thus, Google incorporates by reference its responses to the allegations in paragraphs 1 through 77. Google admits that the following language quoted in the paragraph appears on a Google website: “The VPU handles float32 and int32 computations.” Google admits that the language depicted in the image in this paragraph appears in U.S. Patent No. 10,621,269. Several of the terms in this paragraph are vague and undefined; thus, Google lacks sufficient knowledge and information to form a belief as to the truth of those allegations, and on that basis denies them. This paragraph also incorporates argument and legal conclusions regarding claim language, to which no response is required, but to the extent a response is required, Google denies the allegations. Google denies the remaining allegations in this paragraph, and specifically denies that it has committed any acts of infringement.

79. Google admits that U.S. Patent No. 10,621,269 contains the following language: “The vector processor consists of a 2-dimensional array of vector processing units, i.e., 128×8, which all execute the same instruction in a single-instruction, multiple-data (SIMD) manner.” Google admits that U.S. Patent No. 10,621,269 also contains the following language: “In order to compute the addition, the computer (**103b**) performs multiple, i.e., **1024**, operations in one clock-cycle” (emphasis in original). Google admits that U.S. Patent No. 10,621,269 also contains the following language: “Each MXU may have 128 rows and 128 columns.” Google admits that the language depicted in the last image in this paragraph appears in U.S. Patent No. 10,621,269.

Google denies that the material in this paragraph, including text and images, from the cited blog.inten.to website is attributable to Google. Google denies that the language depicted in the first and third image in this paragraph are attributable to Google. Several of the terms in this paragraph are vague and undefined; thus, Google lacks sufficient knowledge and information to form a belief as to the truth of those allegations, and on that basis denies them. This paragraph also incorporates argument and legal conclusions, including allegations regarding claim language, to which no response is required, but to the extent a response is required, Google denies the allegations. Google denies the remaining allegations in this paragraph, and specifically denies that it has committed any acts of infringement.

80. Google admits that the language in the image depicted in this paragraph appears on a Google website. Google denies the remaining allegations in this paragraph, and specifically denies that it has committed any acts of infringement.

81. Singular's allegations in this paragraph incorporate references to allegations "above," which is ambiguous in definition and scope. Thus, Google incorporates by reference its responses to the allegations in paragraphs 1 through 80 in its response. Google admits that the language depicted in the image included in this paragraph appeared on a Google website. Several of the terms in this paragraph are vague and undefined; thus, Google lacks sufficient knowledge and information to form a belief as to the truth of those allegations, and on that basis denies them. This paragraph also incorporates argument and legal conclusions regarding claim language, to which no response is required, but to the extent a response is required, Google denies the allegations. Google denies the remaining allegations in this paragraph, and specifically denies that it has committed any acts of infringement or instructed others to use any technology in an infringing manner.

82. Google denies the allegations of this paragraph, including without limitation the claim of willfulness. Google also specifically denies that it has committed any acts of infringement.

83. Google admits the allegations of this paragraph.

84. Google admits the allegations of this paragraph.

85. Google is without knowledge or information sufficient to form a belief as to the truth of the allegations of this paragraph, and on that basis denies them.

86. Google admits the allegations of this paragraph.

87. Google is without knowledge or information sufficient to form a belief as to the truth of the allegations of this paragraph, and on that basis denies them.

88. Google is without knowledge or information sufficient to form a belief as to the truth of the allegations of this paragraph, and on that basis denies them.

89. Google is without knowledge or information sufficient to form a belief as to the truth of the allegations of this paragraph, and on that basis denies them.

90. Google is without knowledge or information sufficient to form a belief as to the truth of the allegations of this paragraph, and on that basis denies them.

91. Google admits the allegations of this paragraph.

92. Google is without knowledge or information sufficient to form a belief as to the truth of the allegations of this paragraph, and on that basis denies them.

93. Google admits that on June 24, 2011, Joseph Bates spoke to Astro Teller, Johnny Chen, and others at Google. Google is without knowledge or information sufficient to form a belief as to the truth of any remaining allegations of this paragraph, and on that basis denies them.

94. Google is without knowledge or information sufficient to form a belief as to the truth of the allegations of this paragraph, and on that basis denies them.

95. Google is without knowledge or information sufficient to form a belief as to the truth of the allegations of this paragraph, and on that basis denies them.

96. Google admits that on September 17, 2013, Dr. Bates met with Jeffrey Dean and others at Google. Google admits that on September 17, 2013, Jeffrey Dean emailed Dr. Bates, and that email contained the following language: “A few folks here are interested in seeing if we can train neural nets with various kinds of computational inaccuracies.” This paragraph also incorporates argument and legal conclusions regarding claim language, to which no response is required, but to the extent a response is required, Google denies the allegations. Google is without knowledge or information sufficient to form a belief as to the truth of the remaining allegations in this paragraph, and on that basis denies them. Google specifically denies that it has committed any acts of infringement.

97. Google admits that on January 22, 2014, Dr. Bates emailed Jeffrey Dean, and that email contained the following language: “If Google thought Singular’s hardware, software, patents, experience, etc. might be of interest somewhere in the company, this would be the time to talk.” Google admits that on January 23, 2014, Jeffrey Dean emailed Dr. Bates. Google denies the remaining allegations in this paragraph.

98. Google admits that on January 24, 2014, Dr. Bates forwarded a presentation titled “Many-Million Core Processors and their Applications” to Nanette Boden at the email address nanboden@google.com. Google admits that Jeffrey Dean and Norm Jouppi were in the “Cc:” line of Dr. Bates’ email to Boden. Google admits that the presentation contained the following

language: “Confidential, per Google/Singular MNDA, March 2011.” Dr. Bates never advised Google of any particular patents. Google denies all remaining allegations of this paragraph.

99. Google admits that on February 2, 2017, Dr. Bates gave a talk at Google in Mountain View, California. Dr. Bates never advised Google of any particular patents. Google admits that in *Singular v. Google (Singular I)*, No. 1:19-cv-12551 (D. Mass.), Singular produced a document which purportedly is an email from Dr. Bates to James Laudon on March 1, 2017, and which included a PDF attachment titled “Approximate Computing, Embedded AI, Billion Core Systems.” Google is without knowledge or information sufficient to form a belief as to the truth of the remaining allegations of this paragraph, and on that basis denies them.

100. Google admits that on February 20, 2017, Obi Felten emailed Dr. Bates, and that email contained the following language: “Catherine Tornabene from the X IP legal team. Catherine will review your patent family.” Google is without knowledge or information sufficient to form a belief as to the truth of the remaining allegations of this paragraph, and on that basis denies them.

101. Google admits that on March 1, 2017, Jenn Wall emailed Dr. Bates a PDF titled “Mutual Confidentiality and Non-Disclosure Agreement.” Google admits that Paragraph 8 of that PDF contains the following language: “The Company waives any right to allege willful infringement based on notice to or knowledge by Google of any patent identified by the Company to Google (a) under this Agreement or (b) in any communication related to the Transaction prior to the effective date of this Agreement.” Google admits that the PDF defines “Company” as “Singular Computing LLC, for itself and its subsidiaries and affiliates.” Google denies any remaining allegations.

102. Google is without knowledge or information sufficient to form a belief as to the truth of the allegations of this paragraph, and on that basis denies them.

103. Google admits that Dr. Bates had discussions with certain Google employees. Dr. Bates never advised Google of any particular patents. Google is without knowledge or information sufficient to form a belief as to the truth of the remaining allegations of this paragraph, and on that basis denies them. Google specifically denies that it has committed any acts of infringement.

104. Google admits that the screenshots excerpted in this paragraph labeled “Singular Presentations Made to Google” were provided by Dr. Bates to Google as part of his presentations to Google employees. Google admits that Jeff Dean gave a presentation titled “Machine Learning for Systems and Systems for Machine Learning,” excerpts of which are reproduced in this paragraph. Google denies any remaining allegations of this paragraph. This paragraph also includes argument and conclusions to which no response is required, but to the extent a response is required, Google denies the allegations. Google specifically denies that it has committed any acts of infringement.

105. Google admits that its Petitions for *Inter Partes* Review in IPR2021-00154, IPR2021-00155, IPR2021-00164, IPR2021-00165, IPR2021-00178, and IPR2021-00179 referenced application No. 16/882,686. Several of the terms in this paragraph are vague and undefined; thus, Google lacks sufficient knowledge and information to form a belief as to the truth of the remaining allegations, and on that basis denies them.

106. Google admits that its Petitions for *Inter Partes* Review in IPR2021-00154, IPR2021-00155, IPR2021-00164, IPR2021-00165, IPR2021-00178, and IPR2021-00179 referenced application No. 16/882,686. Several of the terms in this paragraph are vague and

undefined; thus, Google lacks sufficient knowledge and information to form a belief as to the truth of any remaining allegations, and on that basis denies them. Google specifically denies that it has committed any acts of infringement.

107. This paragraph includes argument and conclusions to which no response is required, but to the extent a response is required, Google denies the allegations, including without limitation the claim of willfulness. Google specifically denies that it has committed any acts of infringement.

108. Singular's allegations in this paragraph incorporate a reference to unspecified allegations "set forth "above," a reference which is ambiguous and unclear in definition and scope. Thus, Google incorporates by reference its responses to the allegations of paragraphs 1 to 107 above in its response to this paragraph. This paragraph includes argument and conclusions to which no response is required, but to the extent a response is required, Google denies the allegations. Google specifically denies that it has committed any acts of infringement.

109. This paragraph includes argument and conclusions to which no response is required, but to the extent a response is required, Google denies the allegations, including without limitation the claim of willfulness. Google specifically denies that it has committed any acts of infringement.

110. This paragraph includes argument and conclusions to which no response is required, but to the extent a response is required, Google denies the allegations, including without limitation the claim of willfulness. Google specifically denies that it has committed any acts of infringement.

111. This paragraph includes argument and conclusions to which no response is required, but to the extent a response is required, Google denies the allegations, including

without limitation the claim of willfulness. Google specifically denies that it has committed any acts of infringement.

112. This paragraph includes argument and conclusions to which no response is required, but to the extent a response is required, Google denies the allegations, including without limitation the claim of willfulness. Google specifically denies that it has committed any acts of infringement.

113. This paragraph includes argument and conclusions to which no response is required, but to the extent a response is required, Google denies the allegations, including without limitation the claim of willfulness. Google specifically denies that it has committed any acts of infringement.

114. This paragraph includes argument and conclusions to which no response is required, but to the extent a response is required, Google denies the allegations, including without limitation the claim of willfulness. Google specifically denies that it has committed any acts of infringement.

115. This paragraph includes argument and conclusions to which no response is required, but to the extent a response is required, Google denies the allegations. Google specifically denies that it has committed any acts of infringement.

116. Google denies the allegations of this paragraph. Google specifically denies that it has committed any acts of infringement.

PRAYER FOR RELIEF

These paragraphs set forth the statement of relief requested by Singular to which no response is required. Google denies any allegations contained in the Prayer for Relief to which a response is required, including without limitation the claim of willfulness.

Google denies each and every allegation of Singular's complaint not specifically admitted or otherwise responded to above. Google specifically denies that it has infringed or is liable for infringement of any valid and enforceable patent claims of Singular. Google further specifically denies that Singular is entitled to any relief whatsoever of any kind against Google as a result of any act of Google or any person or entity acting on behalf of Google.

DEMAND FOR JURY TRIAL

Singular's demand for a trial by jury for all counts of the complaint does not state any allegation, and Google is not required to respond. To the extent that any allegations are included in the demand, Google denies these allegations.

GOOGLE'S AFFIRMATIVE DEFENSES

Google asserts the following affirmative defenses. To the extent any of the defenses, in whole or in part, relates to or negates an element of Singular's claims, Google in no way seeks to relieve Singular of its burden of proof or persuasion on that element. All defenses are pled in the alternative and do not constitute an admission of liability or that Singular is entitled to any relief whatsoever. Google reserves any and all rights it has under the Federal Rules of Civil Procedure to assert additional defenses and/or counterclaims as additional facts are learned or present themselves during discovery or otherwise during the course of these proceedings.

First Affirmative Defense – Invalidity and/or Non-Patentability (All Counts)

1. The claims of the Patents-in-Suit are invalid and unenforceable for failure to satisfy one or more of the requirements of Title 35 of the United States Code, including without limitation 35 U.S.C. §§ 101, 102, 103, and 112, because the claims are directed to abstract ideas or other non-statutory subject matter, because the claims lack novelty, and are taught and suggested by the prior art, because the claims are obvious in view of the prior art, and because

the claims suffer from a failure of written description, lack of enablement, and claim indefiniteness.

Second Affirmative Defense – Estoppel (All Counts)

2. Plaintiff's claims are barred, in whole or in part, by the doctrines of equitable estoppel and/or prosecution history estoppel.

Third Affirmative Defense – Laches (All Counts)

3. The equitable relief sought by Singular is barred, in whole or in part, by the equitable doctrine of laches.

Fourth Affirmative Defense – Substantial Non-Infringing Uses (All Counts)

4. Any and all products or actions accused of infringement by Singular have substantial uses that do not infringe and do not induce or contribute to the alleged infringement of the claims of the Patents-in-Suit.

Fifth Affirmative Defense – Limitation on Patent Damages (All Counts)

5. Singular's claim for damages, if any, against Google for alleged infringement of the Patents-in-Suit are limited by 35 U.S.C. §§ 286, 287 and/or 288, and by the territorial limits of the United States patent laws.

Sixth Affirmative Defense – Equitable Relief Unavailable (All Counts)

6. Singular is barred from obtaining any equitable relief from Google because any alleged injury to Singular is neither immediate or irreparable, Singular has an adequate remedy at law, and granting equitable relief would not be in the public interest.

Seventh Affirmative Defense – Damages Speculative, Uncertain, and Contingent (All Counts)

7. Singular's alleged damages are speculative, uncertain and/or contingent, have not accrued, and are not recoverable.

Eighth Affirmative Defense – No Injury (All Counts)

8. Singular’s claims are barred, in whole or in part, because Singular has not suffered any injury in fact from the conduct alleged in the Amended Complaint.

Ninth Affirmative Defense – No Causation (All Counts)

9. Google’s conduct was and is neither the cause in fact nor the proximate cause of any injury, loss, or damage alleged by Singular.

Tenth Affirmative Defense – 28 U.S.C. § 1498 (All Counts)

10. To the extent Plaintiff’s allegations of infringement include any method, system, apparatus and/or product used by or manufactured by or for the United States, Plaintiff’s claim for damages for alleged infringement is limited and/or barred by 28 U.S.C. § 1498.

**Eleventh Affirmative Defense – Inequitable Conduct/Fraud on the Patent Office
(’616 and ’775 Patents)**

11. The ’616 and ’775 patents are unenforceable under the doctrine of infectious unenforceability due to the inequitable conduct of the named inventor, Dr. Joseph Bates, during the prosecution of the application leading to U.S. Patent No. 10,416,961 (“the ’961 patent”; the application leading to the ’961 patent is hereafter referred to as “the ’961 application”). As described below, the evidence is uncontroverted that Dr. Bates had in his possession a material prior art reference that was never disclosed during prosecution of the ’961 patent. Dr. Bates appreciated its materiality, as evidenced at least by the fact that [REDACTED]

[REDACTED]. However, when Google sought to ascertain the facts surrounding the non-disclosure of this reference, Dr. Bates and his prosecution attorney responsible for prosecuting the application leading to the ’961 patent asserted privilege at nearly every turn, essentially seeking to shroud Dr. Bates’s failure to disclose the reference behind a veil of secrecy.

12. Dr. Bates's inequitable conduct during prosecution of the '961 patent bears an immediate and necessary relation to the '616 and '775 patents and/or Plaintiff's efforts to enforce the '616 and '775 patents, including because the '616 and '775 patents are continuations of the application that matured into the '961 patent; the '616 and '775 patents claim subject matter that is similar to the '961 patent, at least insofar as they rely on the same specification for support and are alleged by Plaintiff to cover overlapping features in certain of the same accused products; and the '616 and '775 patents claim priority based on the '961 application.

Dr. Bates's Prosecution of the '961 Patent

13. As the sole named inventor on the '961 patent, Dr. Bates was directly involved in the filing and prosecution of the application leading to the issuance of that patent. As the attorney responsible for prosecuting the application leading to the '961 patent, Dr. Bates' prosecution counsel, Robert Plotkin, was directly involved in the filing and prosecution of the application leading to the issuance of the '961 patent.

14. Dr. Bates knew of at least one material prior art publication disclosing and demonstrating public use of the inventions claimed in the '961 patent. With specific intent to deceive, Dr. Bates withheld this publication from the United States Patent and Trademark Office (the "Patent Office") during the prosecution of the '961 patent. On information and belief, the Patent Office would not have allowed one or more claims of the '961 patent had it been aware of the withheld prior art.

15. The prior art that Dr. Bates failed to disclose to the Patent Office during the prosecution of the '961 application includes at least Dr. Pavle Belanović's 2002 thesis titled "Library of Parameterized Hardware Modules for Floating-Point Arithmetic with an Example Application," a publication which also disclosed the public use of a parameterized floating-point library on reconfigurable hardware by Dr. Belanović and Dr. Miriam Leeser ("Dr. Belanović's Thesis" and the "Parameterized Floating-Point Library"). Dr. Belanović's Thesis, and the public uses it discloses, are "but/for" material to at least one claim of the '961 patent.

16. Dr. Bates and Plotkin filed the application leading to the '961 patent on October 30, 2018. Both Dr. Bates and Plotkin were involved in prosecuting the application leading to the '961 patent and had a duty to disclose to the Patent Office all information known to them to be material to patentability. That duty continued throughout the pendency of all claims in the '961 application.

17. The Patent Office did not issue the '961 patent until September 17, 2019. Between October 30, 2018, and September 17, 2019, Dr. Bates and Plotkin had at least the right and opportunity to comment on, and suggest changes to, the application leading to the '961 patent. Dr. Bates and Plotkin submitted at least one information disclosure statement—on January 25, 2019—purporting to identify references pursuant to their ongoing duty to disclose all information known to them to be material to patentability. Dr. Bates and Plotkin were also aware of the duty to disclose material references they had knowledge of prior to filing the application.

18. On information and belief, Dr. Bates deliberately withheld material prior art that he knew of and he instead selectively disclosed only certain, potentially less relevant prior art information. The extent of this decision to withhold was not evident to Google until the last week of fact discovery in the earlier-filed *Singular Computing LLC v. Google, LLC*, Case No. 1:19-cv-12551 (D. Mass. filed Dec. 20, 2019) ("*Singular I*"), when both Dr. Bates and Plotkin were deposed on the last day of discovery at Singular's behest. Specifically, that deposition testimony combined with the documentary evidence demonstrates that Dr. Bates deliberately withheld material prior art references—Dr. Belanović's Thesis and the Parameterized Floating-Point Library—from the Patent Office. On information and belief based on the facts set forth below, Dr. Bates's failure to disclose this material reference and the work described therein was done with the specific intent to deceive the Patent Office into granting the '961 patent.

Dr. Bates's Decision to Withhold Material Prior Art

19. Dr. Bates cultivated ignorance regarding prior art and disregarded numerous warnings that material information or prior art may exist.

20. Plotkin [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED].

21. Plotkin noted in his deposition that [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED].

22. Dr. Bates was also asked during his *Singular I* deposition [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED].

23. Dr. Bates testified that [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED].

24. Dr. Bates, despite [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED].

25. Dr. Bates [REDACTED]

[REDACTED]

[REDACTED].

Dr. Belanović's Thesis and the Parameterized Floating-Point Library

26. In filing the '961 patent, Dr. Bates purported to have invented FPGAs that include “execution units” that Singular contends execute operations with what he claims are “low precision” and a “high dynamic range.” In the specification of the '961 patent, Dr. Bates asserted that “modern FPGAs often devote a significant portion of their area to providing dozens or hundreds of multiplier blocks, which can be used instead of general purpose resources for computations requiring multiplication.” He then dismissed these “modern FPGAs” because their “multiplier blocks typically perform 18 bit or wider integer multiplies.”

27. But Dr. Bates knew that prior to his claimed inventions, others had programmed FPGAs to perform arithmetic operations with low precision and high dynamic range using custom floating-point formats, including at least as discussed in the prior art described below.

28. Dr. Pavle Belanović was a master's student at Northeastern University in Boston in 2002. His thesis advisor was Dr. Miriam Leeser, Professor of Electrical and Computer Engineering at Northeastern University, who specializes in reconfigurable computing.

29. Dr. Belanović's Thesis explains that a person of ordinary skill would be motivated to implement various custom floating-point formats for the same reason Dr. Bates later described in his alleged inventions: "When using floating-point arithmetic, the designer using the library has full control to trade off between range and precision. . . . With a wider exponent field, the designer provides larger range to the signal, while sacrificing precision. Similarly, to increase the precision of a signal at the cost of reduced range, the designer chooses a narrower exponent and wider fraction field." Dr. Belanović noted that "[r]educing datapath bitwidths to their optimal values enables design of more parallel architectures and implementation of larger designs."

30. Dr. Belanović recognized that applications of his research included machine learning, such as "algorithms that are highly parallel and have signal values that have a high enough range to require floating-point representation, yet are tolerant enough to accommodate its lower precision." Dr. Belanović noted that parallel processing was the obvious conclusion of his custom format research: "the range and precision required will ideally necessitate bitwidths significantly lower than those of the IEEE formats, so that higher parallelism may be achieved."

31. As reflected in Dr. Belanović's Thesis, using Wildstar reconfigurable architecture and a Xilinx XCV1000 FPGA, Drs. Belanović and Leeser implemented floating-point multipliers that performed multiplication on inputs with various custom floating-point formats. The custom floating-point formats included formats that provide the dynamic range required by the claims of the '961 patent and formats that result in the degree of error required by the claims of the '961 patent when used in a floating-point multiplier where the output mantissa size matches that of the inputs.

32. Drs. Belanović and Leeser also created the Parameterized Floating-Point Library for use with reconfigurable hardware, a publicly available library for anyone to implement floating-point multipliers in FPGAs with custom floating-point formats, including formats that would cause the multipliers to operate in a manner that satisfies the dynamic range and that

would meet the error requirements in the '961 patent's claims. The Parameterized Floating-Point Library has been available for public use since 2002 and is still available for use now.

33. Dr. Belanović's Thesis describes how, in 2002, Dr. Belanović, under Dr. Leeser's guidance, he applied those custom floating-point formats in experiments using the Wildstar architecture and Xilinx VIRTEX XCV1000 FPGAs. Dr. Belanović's implementation included 255 multipliers. These experiments also included using the Parameterized Floating-Point Library with various floating point formats. Those multiple formats included mantissa sizes that, when used in a floating-point multiplier (like that disclosed in Dr. Belanović's Thesis and in other well-known references) where the output mantissa size matches that of the inputs, would cause the floating-point multiplier to produce the claimed error rates in the '961 patent. Those multiple formats also included exponent sizes that result in the claimed dynamic ranges in the '961 patent. Accordingly, Dr. Belanović's Thesis would have been material to at least claim 1 of the '961 patent in that it would have at least rendered the claimed invention obvious.

Dr. Bates's Awareness of the Belanović Thesis and its Materiality

34. At least Dr. Bates knew of Drs. Belanović and Leeser's work by [REDACTED]

[REDACTED]. Dr. Bates testified during his deposition in *Singular I* that he [REDACTED]

[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED].

35. In 2002, Drs. Belanović and Leeser co-authored an article titled "A Library of Parameterized Floating-Point Modules and Their Use." In it, they noted an inherent concept in computing: "[a] natural tradeoff exists between smaller bitwidths requiring fewer hardware resources and higher bitwidths providing better precision. Also, within a given total bitwidth, it is possible to assign various combinations of bitwidths to the exponent and fraction fields, where

wider exponents result in higher range and wider fractions result in better precision.” Drs. Belanović and Leeser recognized that custom floating-point formats were an inevitable outgrowth of such an understanding, because “[r]educd bitwidth implementations require fewer resources and thus allow for more parallel implementations.”

36. Singular’s production in *Singular I* confirms that [REDACTED]

[REDACTED]. In that case, Singular produced [REDACTED]

[REDACTED]. See SINGULAR 00002261-2343. Dr. Belanović’s Thesis includes, at page 12, a disclosure substantially similar to the text quoted above from the article co-authored by Drs. Belanović and Leeser, stating: “Naturally, a tradeoff exists in total bitwidth between smaller width requiring less hardware resources and higher width providing better precision. Also, within a certain total bitwidth, it is possible to assign various combinations of values to the exponent and fraction fields Wider exponent fields brings higher range and wider fraction fields brings higher precision.”

37. The document was [REDACTED]

38. Dr. Bates testified that [REDACTED]

Dr. Bates's Failure to Disclose and Intent to Deceive

39. Dr. Bates failed to disclose the Belanović Thesis to the Patent Office in connection with prosecution of the application leading to the '961 patent, and, on information and belief, did so with the specific intent to deceive the Patent Office into granting the '961 patent.

40. During prosecution of the '961 application, neither Dr. Bates nor anyone associated with the prosecution ever submitted Dr. Belanović's Thesis to the Patent Office for the examiner's consideration, and Dr. Belanović's Thesis did not otherwise come to the examiner's attention. The file history for the '961 patent does not include Dr. Belanović's Thesis or Drs. Leeser and Belanović's Parameterized Floating-Point Library. Neither Dr. Bates nor any other person associated with the prosecution disclosed the existence of either Dr. Belanović's Thesis or Drs. Leeser and Belanović's Parameterized Floating-Point Library to the Patent Office in connection with the '961 application, or any related application.

41. Both the prior publication (Dr. Belanović's Thesis) and the prior use (Drs. Leeser and Belanović's Parameterized Floating-Point Library) constitute material prior art and would not have been cumulative of other information already on record with the Patent Office. Either piece of prior art alone, or in combination with the knowledge of a person of ordinary skill in the art, or in combination with other prior art, at least renders obvious claim 1 of the '961 patent. On information and belief, the Patent Office would not have allowed at least claim 1 of the '961 patent had either the prior publication (Dr. Belanović's Thesis) or the prior use (Drs. Leeser and Belanović's Parameterized Floating-Point Library) been disclosed to the examiner.

42. Although [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED].

43. Dr. Bates was also asked in his deposition [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

44. Dr. Bates also testified that [REDACTED]

[REDACTED]

[REDACTED]. Dr. Bates also testified that [REDACTED]

[REDACTED].

45. Accordingly, counsel for Google also asked Dr. Bates [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED].

46. In other words, Dr. Bates, [REDACTED]

[REDACTED]

[REDACTED].

47. For his part, Plotkin testified during his deposition (also in *Singular I*) that [REDACTED]

48. Plotkin noted that [REDACTED]

49. Given that Dr. Bates was [REDACTED]

[REDACTED], and given that Dr. Bates testified he [REDACTED]

[REDACTED], the single most reasonable inference to be drawn from these facts is that Dr. Bates was aware of Dr. Belanović's Thesis at a time when he was under a duty to disclose this material reference to the Patent Office in connection with prosecution of the '961 application, but deliberately chose not to in order to deceive the Patent Office into granting the '961 patent. Accordingly, Dr. Bates's inequitable conduct during the prosecution of the application leading to the '961 patent renders the '961 patent unenforceable.

Necessary and Immediate Relation Between the '961 Inequitable Conduct and the '616 and '775 Patents

50. The inequitable conduct committed by Dr. Bates during prosecution of the '961 application bears a necessary and immediate relation to the '616 and '775 patents and/or Singular's attempts to enforce the '616 and '775 patents, such that the inequitable conduct with respect to the '961 patent infects the enforceability of the '616 and '775 patents.

51. The '616 and '775 patents were both filed on May 25, 2020, each as continuations of the same parent application, U.S. Patent Application Serial No. 16/571,871 ("the '871

application”), which matured into U.S. Patent No. 10,664,236. As noted above, the ’871 application was a continuation of the application that matured into the ’961 patent. Thus, the ’961 patent is the grandparent to the ’616 and ’775 patents, because it gave rise to both patents through a series of two continuation applications.

52. The ’961, ’616, and ’775 patents all claim priority to the same provisional application, U.S. Provisional Patent App. No. 61/218,691, filed on June 19, 2009. Specifically, the ’616 and ’775 patents both claim priority to the June 19, 2009 provisional application through a chain of patent applications that includes the ’961 application.

53. The ’961, ’616, and ’775 patents all share the same title: “Processing with Compact Arithmetic Processing Element,” and all share the same (sole) inventor and specification.

54. The claims of the ’961, ’616, and ’775 patents relate to similar subject matter, at least insofar as they rely on the same specification for support and are alleged by Plaintiff to cover overlapping features in certain of the same accused products, and all purport to relate to computing systems for performing arithmetic operations on numerical values of low precision but high dynamic range.

55. Thus, there is an immediate and necessary relation between the inequitable conduct committed by Dr. Bates during prosecution of the application leading to the ’961 patent, on the one hand, and the ’616 and ’775 patents and/or Singular’s attempts to enforce the ’616 and ’775 patents, on the other, such that the inequitable conduct renders the ’616 and ’775 patents unenforceable.

Twelfth Affirmative Defense – Inequitable Conduct/Fraud on the Patent Office (’616 and ’775 Patents)

56. Google re-alleges and incorporates by reference the allegations of its Eleventh Affirmative Defense (Inequitable Conduct / Fraud on the Patent Office) as though fully set forth herein.

57. Separate and apart from the inequitable conduct described above, Dr. Bates's and/or Plotkin's inequitable conduct during the prosecution of the application leading to the '616 patent also renders the '616 patent unenforceable. Because the inequitable conduct as to the '616 patent bears a necessary and immediate relation to Plaintiff's enforcement of the '775 patent, it renders the '775 patent unenforceable.

58. As set forth in greater detail below, Dr. Bates and/or Plotkin was aware of at least four individually material prior art references that he failed to disclose to the Patent Office during prosecution of the application leading to the '616 patent: (1) P. Belanović & M. Leeser, *A Library of Parameterized Floating-Point Modules and Their Use*, in Glesner, M., Zipf, P., and Renovell, M. (Eds.), *Field-Programmable Logic and Applications: Reconfigurable Computing is Going Mainstream*, 12th International Conference, FPL 2002, Montpellier, France, September 2-4, 2002, Proceedings. pp. 657-666 ("Belanović/Leeser"); (2) Shirazi et. al, *Quantitative Analysis of Floating Point Arithmetic on FPGA Based Custom Computing Machines*, Proceedings of the IEEE Symposium on FPGAs for Custom Computing Machines, April 19-21, 1995 ("Shirazi"); (3) Aty et. al, *High-Speed, Area-Efficient FPGA-Based Floating-Point Multiplier*, Proceedings of the 12 IEEE International Conference on Fuzzy Systems, December 11, 2003 ("Aty"); and (4) Dr. Belanović's Thesis. On information and belief based on the facts set forth below, Dr. Bates's failure to disclose these material references was done with the specific intent to deceive the Patent Office into granting the '616 patent. These actions constitute inequitable conduct, rendering the '616 patent unenforceable.

Materiality of Dr. Belanović's Thesis, Belanović/Leeser, Shirazi, and Aty to the '616 patent

59. Dr. Belanović's Thesis, Belanović/Leeser, Shirazi, and Aty were material to the '616 patent in that, on information and belief, the Patent Office would not have allowed at least claim 1 of the '616 patent had any one of these prior art references been disclosed during prosecution of the application leading to the '616 patent.

60. For example, claim 1 of the '616 patent recites a “computing system” comprising a “host computer” and a “computing chip,” which in turn comprises a “processing element array” with a number of “processing element[s]” (PEs) positioned at either an “edge” or “in the interior” of the array. Each of the recited PEs has a “memory” that is “local” to that PE, a “connection” connecting it to another PE, and an “arithmetic unit” that comprises a “multiplier circuit.” The “computing chip” further comprises an “input-output unit” connected to a subset of the recited PEs, and the host computer is “at least partially” connected to the input-output unit through a “host connection.”

61. All of these structural elements of claim 1 of the '616 patent describe little more than an array processor, which was known in the art and admitted to be so by Dr. Bates. Specifically, the specification of the '616 patent admits that “[b]ecause of the weaknesses of conventional computers, such as typical microprocessors, other kinds of computers have been developed to attain higher performance,” which “include[d] single instruction stream/multiple data stream (SIMD) designs.” '616 patent at 3:18-27. The specification also admits that one “particular kind of SIMD computer” is the “array processor,” explaining that array processors “distribute data across a grid of processing elements (PEs),” where each PE “has its own memory,” receives instructions that are “broadcast . . . from a central control un[it],” and “performs the broadcast instruction on its local data.” *Id.* at 7:56-58, 3:37-42. The specification further admits that “[t]here are many variations and specific instances of array processors described in the scientific and commercial literature,” including “the Illiac 4, the Connection Machine 1 and 2, the Goodyear MPP, and the MasPar line of computers.” *Id.* at 7:56-62.

62. Furthermore, while claim 1 of the '616 patent generically recites a handful of other elements, Dr. Bates did not purport to have invented those common elements that were widely known to exist in many computing systems. These include, among others, a “host computer,” “memory,” an “input-output unit,” and a “host connection” between the host computer and the input-output unit. Indeed, where the specification discusses these common elements at all, it does not purport to have invented them. *See, e.g., id.* at 3:37-38 (“Array

processors distribute data across a grid of processing elements (PEs). Each element has its own memory.”); *id.* at 8:29-36 (generic description of “host computer”); *id.* at 25:5-8 (PEs can be connected with “various connection architectures”).

63. The only aspect of the invention in claim 1 of the ’616 patent that the specification even arguably claims as novel is the use of low-precision, high dynamic range arithmetic. For example, according to the specification, the purported novelty of the invention is that the claimed PEs are “designed to perform arithmetic operations . . . on numerical values of low precision but high dynamic range.” ’616 patent at 1:66-2:6. As a further example, the specification asserts that “embodiments of the present invention efficiently provide computing power using a fundamentally different approach” in which “computer processors or other devices . . . use low precision high dynamic range (LPHDR) processing elements to perform computations (such as arithmetic operations).” *Id.* at 5:57-65. As a still further example, the specification asserts that “[o]ne aspect of embodiments of the present invention that is unique is the inclusion of LPHDR arithmetic mechanisms in the PEs.” *Id.* at 11:54-57. As yet another example, the specification expresses Dr. Bates’s view that “it is commonly believed by those having ordinary skill in the art, that LPHDR computation, and in particular massive amounts of LPHDR computation . . . is not practical,” and then claims that “embodiments of the present invention disclosed herein demonstrate that massively parallel LPHDR designs are in fact useful.” *Id.* at 6:55-7:9. *See also id.* at 7:15-18 (“Despite the common belief among those having ordinary skill in the art that modern applications require high precision processing, in fact a variety of useful algorithms function adequately at much lower precision.”).

64. Claim 1 of the ’616 patent recites inputs into the claimed “multiplier circuit[s],” i.e., that both the “first input” and the “second input” to each of the recited multiplier circuits are “floating point value[s] having a . . . binary mantissa of width no more than 11 bits and a . . . binary exponent of width at least 6 bits.” Setting aside whether such limitations are supported by the specification, to the extent claim 1 of the ’616 patent claims the purportedly novel feature of

low-precision high-dynamic range arithmetic, it would be doing so through the way it has claimed the mantissa and exponent elements of this multiplier circuit.

65. Dr. Belanović's Thesis, Belanović/Leeser, Shirazi, and Aty all explicitly disclose floating-point formats with less than 11 mantissa bits and with at least 6 exponent bits, as well as arithmetic units comprising multiplier circuits that operate on such floating-point formats, and that disclosure would have at least rendered obvious claim 1 of the '616 patent because all the other elements of the claim were known in the art.

66. Belanović/Leeser is a prior art reference published in Glesner et al., *Field-Programmable Logic and Applications: Reconfigurable Computing is Going Mainstream* (pp. 657-666) (2002), proceedings of the 12th International Conference on Field Programmable Logic and Application, which took place from September 2-4, 2002 in Montpellier, France. Belanović/Leeser presents and describes the same "parameterized floating-point library" discussed above that was disclosed in Dr. Belanović's Thesis. More specifically, Belanović/Leeser presents a "parameterized floating-point format and library of arithmetic operators to support it," which "supports a broad range of floating-point formats, including the IEEE standard formats as a subset." As context, the authors, Drs. Belanović and Leeser, noted an inherent "tradeoff" in the selection of a given floating-point number format, which is that "smaller bitwidths requir[e] fewer hardware resources" but that "higher bitwidths provid[e] better precision." The authors also noted that "within a given total bitwidth, it is possible to assign various combinations of bitwidths to the exponent and fraction fields, where wider exponents result in higher range and wider fractions result in better precision." The authors recognized that custom floating-point formats were an inevitable outgrowth of such an understanding, because "much smaller bitwidths than those specified in the [IEEE] 754 standard are sufficient to provide the desired precision" and the "[r]educd bitwidth implementations require fewer resources and thus allow for more parallel implementations than using the full IEEE standard format." Belanović/Leeser explicitly discloses at least one floating-point number format with less than 11 mantissa bits and with at least 6 exponent bits, as well as a

corresponding multiplier. For example, Belanović/Leeser discloses a 16-bit floating-point format dubbed “C2” that comprises a 9-bit mantissa and 6-bit exponent. Dr. Belanović’s Thesis contains substantially similar disclosures, as described above, and would be material for the same reasons as Belanović/Leeser.

67. Shirazi is a prior art reference published in the Proceedings of the IEEE Symposium on FPGAs for Custom Computing Machines, which took place from April 19-21, 1995. Shirazi is generally directed to the subject of custom floating-point number formats for use in FPGA-based custom computing machines. More specifically, Shirazi “examines the implementations of various arithmetic operators using two floating point formats similar to the IEEE 754 standard.” Shirazi describes how the authors synthesized (i.e., designed) “adders/subtractors, multipliers, and dividers . . . for Xilinx 4010 FPGAs” that operate on two custom number formats—“[e]ighteen and sixteen bit floating point.” As illustrated in Figure 2 of Shirazi, Shirazi’s “18 bit floating point format” comprises a 10-bit mantissa and a 7-bit exponent, and Shirazi describes an “18 bit floating point multiplier” to perform multiplication of operands represented in this floating point format:

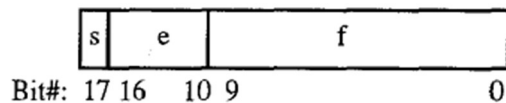


Figure 2: 18 Bit Floating Point Format.

68. As illustrated in Figure 3 of Shirazi, Shirazi's "16 bit floating point format" comprises a 9-bit mantissa and a 6-bit exponent, and Shirazi describes a 16-bit floating point multiplier to perform multiplication of operands represented in this floating point format:

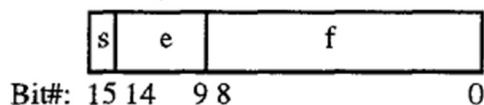


Figure 3: 16 Bit Floating Point Format.

69. As seen above, Shirazi explicitly discloses at least one floating-point number format with less than 11 mantissa bits and with at least 6 exponent bits, as well as a corresponding multiplier.

70. Notably, Shirazi is discussed in Dr. Belanović's Thesis and referenced in Belanović/Leeser, which describes Shirazi as "significant work" that "provide[d] two custom floating-point formats (16 bits and 18 bits total) as well as addition, subtraction, multiplication and division operators in those formats."

71. Aty is a prior art reference published in the Proceedings of the 12th IEEE International Conference on Fuzzy Systems, which took place on December 11, 2003. Aty is generally directed to the subject of a high-speed and area-efficient floating-point multiplier that is implemented on an FPGA-based system. More specifically, Aty presents a "floating-point multiplier" for real-time signal processing on a FPGA. Aty describes "[f]loating-point multipliers" that operate on floating-point numbers represented as "16, 18, 32, and 64 bits."

72. Aty explicitly discloses at least one floating-point number format with less than 11 mantissa bits and with at least 6 exponent bits, as well as a corresponding multiplier. For example, similar to Shirazi, Aty explains that its "18-bit floating-point format" comprises a 10-bit mantissa and a 7-bit exponent ("m=10, n=7"). Similar to Shirazi, Aty explains that its 16-bit floating point format comprises a 9-bit mantissa and a 7-bit exponent ("Mant 9, Exp 6").

73. Accordingly, on information and belief, the Patent Office would not have allowed at least claim 1 of the '616 patent had any one of these prior art references been disclosed during prosecution of the application leading to the '616 patent.

Dr. Bates's and/or Plotkin's Awareness of Dr. Belanović's Thesis, Belanović/Leeser, Shirazi, and Aty, and Their Materiality

74. On information and belief based on the facts set forth below, Dr. Bates and/or Plotkin was aware of Dr. Belanović's Thesis, Belanović/Leeser, Shirazi, and Aty and of the materiality of these references, at a time when he was under a duty to disclose these references to the Patent Office in connection with prosecution of the application leading to the '616 patent.

75. As discussed above and as reflected in Dr. Bates's deposition testimony, Dr. Bates [REDACTED]

[REDACTED]. Dr. Bates testified during his deposition in *Singular I* that he [REDACTED]

[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]. Dr. Bates testified that [REDACTED]
[REDACTED]
[REDACTED].

76. Singular's production in *Singular I* confirms that [REDACTED]
[REDACTED]
[REDACTED]. As discussed above, in *Singular I*, Singular [REDACTED]
[REDACTED]
[REDACTED]. See SINGULAR 00002261-2343.

77. Moreover, on September 17, 2020, in connection with the prosecution of the application leading to the '775 patent, Dr. Bates and Plotkin identified Belanović/Leeser, Shirazi, and Aty in an Information Disclosure Statement ("IDS"). This September 17, 2020 IDS was submitted to the Patent Office just over 3 weeks after the '616 patent issued. On information and belief, Dr. Bates and/or Plotkin were aware of Belanović/Leeser, Shirazi, and Aty more than 3 weeks prior to the September 17, 2020 IDS, at a time when they were under a duty to disclose these references to the Patent Office in connection with prosecution of the application leading to the '616 patent.

78. Dr. Bates and/or Plotkin was aware that Dr. Belanović's Thesis, Belanović/Leeser, Shirazi, and Aty were material to the '616 patent at a time when he was under a duty to disclose these references to the Patent Office in connection with prosecution of the application leading to the '616 patent. As discussed in more detail below, the applications leading to the '616 and '775 patents were filed the same day and claim substantially similar inventions. Indeed, as seen in the table below, every limitation of claim 1 of the '616 patent can be found in claim 1 of the '775 patent. As such, the identification of Belanović/Leeser, Shirazi, and Aty in the September 17, 2020 IDS during prosecution of the application leading to the '775 patent shows that Dr. Bates and/or Plotkin recognized the relevance of Dr. Belanović's Thesis, Belanović/Leeser, Shirazi, and Aty and their materiality to the '616 patent, as well.

Dr. Bates's and/or Plotkin's Failure to Disclose and Intent to Deceive

79. Dr. Bates and/or Plotkin failed to disclose Dr. Belanović's Thesis, Belanović/Leeser, Shirazi, and Aty to the Patent Office in connection with prosecution of the application leading to the '616 patent, and, on information and belief, did so with the specific intent to deceive the Patent Office into granting the '616 patent.

80. During prosecution of the application leading to the '616 patent, neither Dr. Bates nor Plotkin submitted any prior art references to the Patent Office for the examiner's

consideration. As reflected in the file history of the application leading to the '616 patent, only three references were cited during prosecution, and they were all identified by the examiner.

81. On information and belief, Dr. Bates and/or Plotkin failed to disclose Dr. Belanović's Thesis, Belanović/Leeser, Shirazi, and Aty to the Patent Office during prosecution of the '616 patent with the specific intent to deceive the Patent Office into granting the '616 patent. As discussed above, the applicant identified three of the references (Belanović/Leeser, Shirazi, and Aty) to the Patent Office in a September 17, 2020 IDS in connection with the prosecution of the application leading to the '775 patent, just over 3 weeks after the '616 patent issued. The single most reasonable inference able to be drawn from these facts is that Dr. Bates and/or Plotkin was aware of Belanović/Leeser, Shirazi, and Aty before they were disclosed in the September 17, 2020 IDS and at a time when he was under a duty to disclose the references to the Patent Office in connection with prosecution of the application leading to the '616 patent, but deliberately delayed doing so in order to deceive the Patent Office into granting the '616 patent. Moreover, on information and belief, Dr. Bates and/or Plotkin waited to disclose Belanović/Leeser, Shirazi, and Aty during prosecution of the application that resulted in the '775 patent, knowing that once the examiner allowed the claims of the '616 patent, the examiner would be highly likely to allow the substantially similar claims of the '775 patent, notwithstanding the disclosure. Accordingly, because of Dr. Bates's and/or Plotkin's inequitable conduct during prosecution of the application leading to the '616 patent, the '616 patent is unenforceable.

Necessary and Immediate Relation Between the '616 Inequitable Conduct and the '775 Patent

82. Dr. Bates's and/or Plotkin's inequitable conduct during the prosecution of the application leading to the '616 patent bears a necessary and immediate relation to the '775 patent and/or Singular's attempts to enforce the '775 patent, such that the inequitable conduct with respect to the '616 patent renders the '775 patent unenforceable.

83. The applications leading to the '616 and '775 patents were filed on the same day, and each is a continuation application of U.S. Patent App. No. 16/571,871, now U.S. Patent No. 10,664,236 ("the '236 patent"). Thus, the applications leading to the '616 and '775 patents are "sibling" continuation applications that both claim priority to the '236 patent.

84. Both the '616 and '775 patents are titled, "Processing with Compact Arithmetic Processing Element," and share the same inventor and specification.

85. The claims of the '616 and '775 patents are directed to similar subject matter, at least insofar as they rely on the same specification for support and are alleged by Plaintiff to cover overlapping features in certain of the same accused products. Both patents' claims relate to computing systems for performing arithmetic operations on numerical values of low precision but high dynamic range. By way of example, the similarities between claim 1 of the '616 patent and claim 1 of the '775 patent are illustrated in the chart below:

'616 Patent, Claim 1	'775 Patent, Claim 1
A computing system, comprising:	A computing system, comprising:
a host computer;	a host computer;
a computing chip comprising:	a computing chip comprising:
a processing element array comprising a first edge processing element positioned at a first edge of the processing element array, a second edge processing element positioned at the first edge of the processing element array, a first interior processing element positioned at a first location in an interior of the processing element array, and a second interior processing element positioned at a second location in the interior of the processing element array;	a processing element array comprising a first edge processing element positioned at a first edge of the processing element array, a second edge processing element positioned at the first edge of the processing element array, a first interior processing element positioned at a first location in the interior of the processing element array, and a second interior processing element positioned at a second location in the interior of the processing element array;

a first processing element connection connecting the first edge processing element with the first interior processing element;	a first processing element connection connecting the first edge processing element with the first interior processing element;
a second processing element connection connecting the second edge processing element with the second interior processing element;	a second processing element connection connecting the second edge processing element with the second interior processing element;
an input-output unit connected to the first edge processing element and the second edge processing element;	an input-output unit connected to the first edge processing element and the second edge processing element;
a first memory local to the first edge processing element;	a first memory local to the first edge processing element;
a second memory local to the second edge processing element;	a second memory local to the second edge processing element;
a third memory local to the first interior processing element; and,	a third memory local to the first interior processing element; and,
a fourth memory local to the second interior processing element;	a fourth memory local to the second interior processing element; and,
	a fifth arithmetic unit;
wherein the first edge processing element comprises a first arithmetic unit;	wherein the first edge processing element comprises a first arithmetic unit;
wherein the second edge processing element comprises a second arithmetic unit;	wherein the second edge processing element comprises a second arithmetic unit;
wherein the first interior processing element comprises a third arithmetic unit; and	wherein the first interior processing element comprises a third arithmetic unit; and

wherein the second interior processing element comprises a fourth arithmetic unit; and,	wherein the second interior processing element comprises a fourth arithmetic unit; and,
a host connection at least partially connecting the input--output unit with the host computer;	a host connection at least partially connecting the input--output unit with the host computer;
wherein the first, second, third and fourth arithmetic units each comprises a corresponding multiplier circuit adapted to receive as a first input to the corresponding multiplier circuit a first floating point value having a first binary mantissa of width no more than 11 bits and a first binary exponent of width at least 6 bits, and to receive as a second input to the corresponding multiplier circuit a second floating point value having a second binary mantissa of width no more than 11 bits and a second binary exponent of width at least 6 bits.	wherein the first, second, third and fourth arithmetic units each comprises a corresponding multiplier circuit adapted to receive as a first input to the corresponding multiplier circuit a first floating point value having a first binary mantissa of width no more than 11 bits and a first binary exponent of width at least 6 bits, and to receive as a second input to the corresponding multiplier circuit a second floating point value having a second binary mantissa of width no more than 11 bits and a second binary exponent of width at least 6 bits;
	wherein the fifth arithmetic unit comprises a corresponding multiplier circuit adapted to receive as inputs to the 5 corresponding multiplier circuit two floating point values each of width at least 32 bits;

	wherein the multiplier circuit corresponding to the first arithmetic unit comprises a first plurality of transistors and has no other transistors, the multiplier circuit corresponding to the second arithmetic unit comprises a second plurality of transistors and has no other transistors, the multiplier circuit corresponding to the third arithmetic unit comprises a third plurality of 15 transistors and has no other transistors, the multiplier circuit corresponding to the fourth arithmetic unit comprises a fourth plurality of transistors and has no other transistors, and the multiplier circuit corresponding to the fifth arithmetic unit comprises a fifth plurality of 20 transistors; and,
	wherein the fifth plurality of transistors exceeds in number each of the first plurality of transistors, the second plurality of transistors, the third plurality of transistors, and the fourth plurality of transistors.

86. Thus, there is an immediate and necessary relation between the inequitable conduct committed by Dr. Bates and/or Plotkin during prosecution of the application that led to the '616 patent, on the one hand, and the '775 patent and/or Plaintiff's attempts to enforce the '775 patent, on the other, such that the inequitable conduct also renders the '775 patent unenforceable.

**Thirteenth Affirmative Defense – Inequitable Conduct/Fraud on the Patent Office
(‘616 and ‘775 Patents)**

87. Google re-alleges and incorporates by reference the allegations of its Eleventh and Twelfth Affirmative Defenses (Inequitable Conduct / Fraud on the Patent Office) as though

fully set forth herein. Based on the foregoing, Plaintiff's claims and the relief it seeks are barred by the doctrine of unclean hands.

EXCEPTIONAL CASE

On information and belief, this is an exceptional case entitling Google to an award of its attorneys' fees incurred in connection with defending this action pursuant to 35 U.S.C. § 285, as a result of, *inter alia*, Plaintiff's assertion of the Patents-in-Suit against Google with the knowledge that Google does not infringe any valid or enforceable claim of the Patents-in-Suit and/or that the Patents-in-Suit are invalid and/or unenforceable.

PRAYER FOR RELIEF

WHEREFORE, Google respectfully requests the Court to enter judgment in its favor and against Singular as follows:

- a. For a judgment dismissing Singular's Amended Complaint against Google with prejudice; and
- b. For a judgment that the Patents-in-Suit, and every asserted claim thereof, are not infringed, invalid, and unenforceable;
- c. For an order that Google is the "prevailing party" with respect to Singular's patent claims and that this case is "exceptional" within the meaning of 35 U.S.C. § 285, and for an award granting Google its reasonable attorney's fees and costs, as permitted by law or equity;
- d. A judgment limiting or barring Plaintiff's ability to enforce the Patents-in-Suit in equity;
- e. Such other and further relief as this Court may deem just and proper.

JURY DEMAND

Google hereby demands a jury trial for all issues so triable.

Respectfully submitted,

Dated: April 11, 2022

By: /s/ Nathan R. Speed

GREGORY F. CORBETT (BBO #646394)

gcorbett@wolfgreenfield.com

NATHAN R. SPEED (BBO #670249)

nspeed@wolfgreenfield.com

ANANT K. SARASWAT (BBO #676048)

asaraswat@wolfgreenfield.com

WOLF, GREENFIELD & SACKS, P.C.

600 Atlantic Avenue

Boston, MA 02210

Telephone: (617) 646-8000

Fax: (617) 646-8646

ROBERT VAN NEST (*pro hac vice*)

rvannest@keker.com

MICHELLE YBARRA (*pro hac vice*)

mybarra@keker.com

EUGENE M. PAIGE (*pro hac vice*)

epaige@keker.com

ANDREW BRUNS (*pro hac vice*)

abruns@keker.com

VISHESH NARAYEN (*pro hac vice*)

vnarayan@keker.com

DEEVA SHAH (*pro hac vice*)

dshah@keker.com

STEPHANIE J. GOLDBERG (*pro hac vice*)

sgoldberg@keker.com

KEKER, VAN NEST & PETERS LLP

633 Battery Street

San Francisco, CA 94111-1809

(415) 391-5400

MICHAEL S. KWUN*
mkwun@kblfirm.com
ASIM BHANSALI*
abhansali@kblfirm.com
KWUN BHANSALI LAZARUS LLP
555 Montgomery Street, Suite 750
San Francisco, CA 94111

Matthias A. Kamber (*pro hac vice*)
matthiaskamber@paulhastings.com
PAUL HASTINGS, LLP
101 California Street
Forty-Eighth Floor
San Francisco, CA 94111

Attorneys for Defendant Google LLC

CERTIFICATE OF SERVICE

I certify that this document is being filed through the Court's electronic filing system, which serves counsel for other parties who are registered participants as identified on the Notice of Electronic Filing (NEF). Any counsel for other parties who are not registered participants are being served by first class mail on the date of electronic filing.

Dated: April 11, 2022

/s/ Nathan R. Speed
Nathan R. Speed